
Research Interests

Experimental Cosmology

Observations of Cosmic Microwave Background (CMB) polarization anisotropy
Detection of degree-scale *B*-mode polarization signal from inflationary gravitational waves
Development of instrumentation for balloon-borne and ground-based CMB telescopes

Submillimetre Astronomy

Observations of polarized thermal dust emission from Galactic molecular clouds

Research Skills

Data Analysis

Analysis of CMB and sub-mm polarimetric data incl. timestream and map-level analysis
Telescope beam (PSF) modelling & characterization
Planning & simulation of CMB telescope observing/scan strategies
Fitting to visible/NIR spectroscopic data

Instrumentation

Cryogenic testing of bolometric detector arrays
Suborbital (balloon) payload systems design incl. power, control systems, & telemetry
Data acquisition systems and readout electronics

General

CAD with SolidWorks
Machine shop certification incl. use of mill and lathe
Electronic circuit design, assembly, and PCB layout
DSP and FPGA (VHDL) programming
Programming in C, Python, Matlab, and IDL
Parallel computing
General computing in Linux, Mac OS, and Windows

Education

Doctor of Philosophy (PhD) in Astrophysics

Thesis Advisor: C. Barth Netterfield
Department of Astronomy & Astrophysics, University of Toronto

2008–2015
Toronto, ON, Canada

Bachelor of Applied Science (BASC) in Engineering Physics

University of British Columbia

2003–2008
Vancouver, BC, Canada

Research Experience

Postdoctoral Fellow

Canadian Institute for Theoretical Astrophysics (CITA)

Jan. 2017–Present
Toronto, ON, Canada

Analyzing CMB polarization data from the ~ 4500 deg² survey of the Southern sky at 150 GHz and 94 GHz carried out during the first flight of the SPIDER experiment

Scientific Journal Peer Reviewer

American Astronomical Society (AAS) Journals

Oct. 2016
Cleveland, OH, USA

Peer-reviewed a manuscript for submission to The Astrophysical Journal Supplement Series (ApJS).

Postdoctoral Scholar

Case Western Reserve University Dept. of Physics

Sept. 2015–Jan. 2017
Cleveland, OH, USA

Developed and operated a system for cryogenic testing of multichroic transition-edge sensor (TES) bolometric detector arrays for the third-generation polarization-sensitive instrument on the South Pole Telescope (SPT-3G)

PhD Candidate

University of Toronto Dept. of Astronomy & Astrophysics

Sept. 2008–Aug. 2015
Toronto, ON, Canada

Developed and integrated the SPIDER balloon-borne telescope pointing control system & observing strategy. Developed and integrated SPIDER's flight power system. Worked with colleagues at Princeton University (Oct. 2012–Mar. 2013) on the integration of SPIDER's warm readout electronics. Participated in the field campaigns to integrate, test, and launch SPIDER at NASA's Columbia Scientific Balloon Facility (CSBF) in Palestine, TX (Jun.–Aug. 2013) and at McMurdo Station, Antarctica (Oct. 2014–Jan. 2015).

Worked as a member of the instrument team for the BLASTPol balloon-borne telescope. Used I , Q , and U maps from the 2012 BLASTPol flight to investigate the spatial and spectral variation of the fractional polarization of dust thermal emission in the Carina Nebula.

Research Experience (Continued)

Graduate Researcher

University of Toronto Dept. of Astronomy & Astrophysics

April–Sept. 2009
Toronto, ON, Canada

Short project under the supervision of Prof. Dae-Sik Moon. Reduced data from the LRIS spectrograph on the Keck I 10 m telescope. Produced visible-light spectra of the extended nebular region surrounding the ultra-luminous X-ray source Holmberg IX X-1. Results published after additional analysis (Moon, Harrison, Cenko, and [Shariff 2011](#)).

Summer Undergraduate Researcher

University of Lethbridge Dept. of Physics & Astronomy

May–Aug. 2007
Lethbridge, AB, Canada

Designed and built electronics and control software for a black-body shutter system for use with the Fourier Transform Spectrometer on the SCUBA 2 instrument. Worked under the supervision of Prof. David Naylor.

Summer Undergraduate Researcher

University of Lethbridge Dept. of Physics & Astronomy

May–Aug. 2006
Lethbridge, AB, Canada

Assembled and developed control software for a visible-light Fourier Transform Spectrometer (FTS) based on the Michelson design. Also learned about the design and theory of the FTS attached the SPIRE instrument on the *Herschel* space telescope. Worked under the supervision of Prof. David Naylor.

Engineering Co-op Student

Sudbury Neutrino Observatory

Sept.–Dec. 2005
Sudbury, ON, Canada

Worked as a detector operator in the surface and underground SNOLAB facilities. Monitored the event rate, maintained the log, and was responsible for distinguishing amongst different types of particle detections and other events. Also worked on a design for a replacement surface-to-underground fibre optic communications system.

Talks

Research

Mar. 18, 2016	<i>CMB Lensing Basics</i>	CERCA Seminar at Case Western Reserve University (30-min. dept. seminar)
Feb. 25, 2016	<i>Searching for the Echoes of Inflation from Antarctica</i>	CIERA Special Seminar at Northwestern University (1-hr. dept. seminar)
Jun. 23, 2014	<i>Pointing control for the SPIDER balloon-borne telescope</i>	SPIE Astronomical Telescopes & Instrumentation (20-min. conference talk)
Mar. 12, 2014	<i>SPTpol and SPT-3G: The Second- and Third-Generation Cameras for the South Pole Telescope</i>	University of Toronto (15-min. dept. seminar)
Apr. 3, 2013	<i>SPIDER: Cryogenic System Overview</i>	University of Toronto (15-min. dept. seminar)
Jan. 11, 2012	<i>Pointing Control for Balloon-borne Telescopes</i>	University of Toronto (15-min. dept. seminar)

Public Outreach

Aug. 6, 2015	<i>Astronomical Adventures in Antarctica: From the Bottom of the World to the Beginning of Time</i>	University of Toronto (1-hr. public lecture) AstroTours
Mar. 5, 2015	<i>Astronomical Adventures in Antarctica</i>	University of Toronto (1-hr. public lecture) Ismaili Students Association
Apr. 9, 2009	<i>Astronomy: A Film Odyssey</i>	University of Toronto (1-hr. public lecture) AstroTours

Publications

Journal Articles

- [1] N. N. Gandilo et al. "Submillimeter Polarization Spectrum in the Vela C Molecular Cloud". In: *ArXiv e-prints* (Dec. 2015). (Accepted by *ApJ*). arXiv: [1512.06745](https://arxiv.org/abs/1512.06745).

- [2] S. A. Bryan et al. "A cryogenic rotation stage with a large clear aperture for the half-wave plates in the SPIDER instrument". In: *Review of Scientific Instruments* 87, 014501 (Jan. 2016). arXiv: [1510.01771](#).
- [3] L. M. Fissel et al. "Balloon-Borne Submillimeter Polarimetry of the Vela C Molecular Cloud: Systematic Dependence of Polarization Fraction on Column Density and Local Polarization-Angle Dispersion". In: *ArXiv e-prints* (Sept. 2015). (Accepted by ApJ). arXiv: [1509.05298](#).
- [4] J. E. Guðmundsson et al. "The Thermal Design, Characterization, and Performance of the SPIDER Long-Duration Balloon Cryostat". In: *Cryogenics* 72, 65 (Dec. 2015). arXiv: [1506.06953](#).
- [5] F. Poidevin et al. "Comparison of Prestellar Core Elongations and Large-Scale Molecular Cloud Structures in the Lupus I Region". In: *ApJ* 791, 43 (July 2014). arXiv: [1405.0331](#).
- [6] T. G. Matthews et al. "Lupus I Observations from the 2010 Flight of the Balloon-borne Large Aperture Submillimeter Telescope for Polarimetry". In: *ApJ* 784, 116 (Apr. 2014). arXiv: [1307.5853](#).
- [7] A. A. Fraisse et al. "SPIDER: probing the early Universe with a suborbital polarimeter". In: *J. Cosmology Astropart. Phys.* 4, 047 (Apr. 2013). arXiv: [1106.3087](#).
- [8] D.-S. Moon, F. A. Harrison, S. B. Cenko, and **J. A. Shariff**. "Large Highly Ionized Nebulae Around Ultra-luminous X-ray Sources". In: *ApJ* 731, L32 (Apr. 2011). arXiv: [1103.2773](#).
- [9] D. T. O'Dea et al. "SPIDER Optimization II: Optical, Magnetic, and Foreground Effects". In: *ApJ* 738, 63 (Sept. 2011). arXiv: [1102.0559](#).

Conference Proceedings

- [1] **J. A. Shariff** et al. "Pointing control for the SPIDER balloon-borne telescope". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. June 2014. arXiv: [1407.1880](#).
- [2] A. S. Rahlin et al. "Pre-flight integration and characterization of the SPIDER balloon-borne telescope". In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy VII*. Vol. 9153. Proceedings of the SPIE. June 2014. arXiv: [1407.2906](#).
- [3] N. Galitzki et al. "The Balloon-borne Large Aperture Submillimeter Telescope for Polarimetry-BLASTPol: performance and results from the 2012 Antarctic flight". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. July 2014. arXiv: [1407.3815](#).
- [4] J. D. Soler et al. "Design and construction of a carbon fiber gondola for the SPIDER balloon-borne telescope". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. June 2014. arXiv: [1407.1881](#).
- [5] J. D. Soler et al. "Thermal design and performance of the balloon-borne large aperture submillimeter telescope for polarimetry BLASTPol". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. July 2014. arXiv: [1407.2670](#).
- [6] S. J. Benton et al. "BLASTbus electronics: general-purpose readout and control for balloon-borne experiments". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. June 2014. arXiv: [1407.1882](#).
- [7] N. N. Gandilo et al. "Attitude determination for balloon-borne experiments". In: *Ground-based and Airborne Telescopes V*. Vol. 9145. Proceedings of the SPIE. June 2014. arXiv: [1407.1883](#).

- [8] E. Pascale et al. “The balloon-borne large-aperture submillimeter telescope for polarimetry–BLASTPol: performance and results from the 2010 Antarctic flight”. In: *Ground-based and Airborne Telescopes IV*. Vol. 8444. Proceedings of the SPIE. Sept. 2012.
- [9] S. A. Bryan et al. “Modeling and characterization of the SPIDER half-wave plate”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy V*. Vol. 7741. Proceedings of the SPIE. July 2010. arXiv: [1006.3874](https://arxiv.org/abs/1006.3874).
- [10] M. C. Runyan et al. “Design and performance of the SPIDER instrument”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy V*. Vol. 7741. Proceedings of the SPIE. July 2010. arXiv: [1106.2173](https://arxiv.org/abs/1106.2173).
- [11] J. P. Filippini et al. “SPIDER: a balloon-borne CMB polarimeter for large angular scales”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy V*. Vol. 7741. Proceedings of the SPIE. July 2010. arXiv: [1106.2158](https://arxiv.org/abs/1106.2158).
- [12] J. E. Guðmundsson et al. “Thermal architecture for the SPIDER flight cryostat”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy V*. Vol. 7741. Proceedings of the SPIE. July 2010. arXiv: [1106.2507](https://arxiv.org/abs/1106.2507).
- [13] L. M. Fissel et al. “The balloon-borne large-aperture submillimeter telescope for polarimetry: BLAST-Pol”. In: *Millimeter, Submillimeter, and Far-Infrared Detectors and Instrumentation for Astronomy V*. Vol. 7741. Proceedings of the SPIE. July 2010. arXiv: [1007.1390](https://arxiv.org/abs/1007.1390).

Media Interviews

Jan. 19, 2015	<i>SPIDER: Hunting for signals in the universe’s oldest light</i>	The Varsity (Newspaper) Nadezhda Woinowsky-Krieger
Jan. 18, 2015	<i>Canadian scientists seek to unravel Big Bang mystery over Antarctica</i>	CTV National News (Television) John Vennavally-Rao
Dec. 19, 2014	<i>Canadian scientists on Antarctic mission aim to reveal cosmic origins</i>	The Globe and Mail (Newspaper) Ivan Semeniuk
Dec. 9, 2014	<i>Welcome to Antarctica: counting down to the launch of SPIDER</i>	University of Toronto News (Online) Jennifer Lanthier
Dec. 2014	<i>When Time Began: A new telescope may shed light on the universe’s first moments</i>	U of T Magazine (Online and Print) Dan Falk
Oct. 23, 2014	<i>Antarctica Trip</i>	CBC Toronto Metro Morning (Radio) Matt Galloway

Teaching Experience

Tutorial Teaching Assistant (AST 201: Stars & Galaxies)
University of Toronto Dept. of Astronomy & Astrophysics

Jan.–April 2010
Toronto, ON, Canada

Worked as a tutorial TA for AST 201, a breadth course for humanities majors at the U of T with an enrolment of >1200 students. Taught three tutorial sections of ~45 students each. Attempted to provide a more in-depth understanding of material covered in the lectures, in addition to exam prep. and answering students' conceptual and homework-related questions.

Tutorial Teaching Assistant (AST 101: The Sun & Its Neighbours)
University of Toronto Dept. of Astronomy & Astrophysics

Sept.–Dec. 2009
Toronto, ON, Canada

Worked as a tutorial TA for AST 101, a breadth course for humanities majors at the U of T with an enrolment of >1200 students. Taught three tutorial sections of ~45 students each. Attempted to provide a more in-depth understanding of material covered in the lectures, in addition to exam prep. and answering students' conceptual and homework-related questions.

Head Teaching Assistant (AST 201: Stars & Galaxies)
University of Toronto Dept. of Astronomy & Astrophysics

Jan.–April 2009
Toronto, ON, Canada

Worked as the head TA for AST 201. Administrated the entire course and was responsible for coordinating the actions of all other TAs (tutorial TAs and graders).

Teaching Assistant (AST 101: The Sun & Its Neighbours)
University of Toronto Dept. of Astronomy & Astrophysics

Sept.–Dec. 2008
Toronto, ON, Canada

Worked as TA for AST 101 in a primarily logistical role. This TAship served as training for my subsequent appointment as head TA in the following semester (see above).

Public Outreach Experience

Graduate Student Representative

Education and Public Outreach (EPO) Committee
University of Toronto Dept. of Astronomy & Astrophysics

Mar. 2011–Sept. 2013
Toronto, ON, Canada

Served on the EPO committee, which coordinated the education and public outreach efforts of the three major astrophysics institutes at the U of T: the Department of Astronomy & Astrophysics, the Canadian Institute for Theoretical Astrophysics (CITA), and the Dunlap Institute for Astronomy & Astrophysics. Reported to the committee on outreach activities held by grad students. Helped to organize and run major outreach events led by the Dunlap Institute, such as the 2012 Transit of Venus event that engaged thousands of people at the U of T Varsity Stadium.

Astronomy Public Tour Coordinator

University of Toronto Dept. of Astronomy & Astrophysics

Sept. 2008–Sept. 2011
Toronto, ON, Canada

Helped conduct the graduate-student-run free monthly astronomy public tours at the U of T downtown campus. These events consist of an hour-long public lecture by a researcher in the department, followed by telescopic observing from the roof of the physics building, and planetarium shows. Served as a volunteer (2008-2010) to help organize on the night of the event. Later became the coordinator in charge of the tours, along with one other grad student (2010-2011). Was responsible for recruiting speakers and volunteers, advertising the tours, maintaining the mailing list and website, and other logistical tasks.

Executive Committee Member, The Amazing Science Chase

Science Rendezvous, University of Toronto

Sept. 2009–May 2010
Sept. 2008–May 2009
Toronto, ON, Canada

For two years running, helped to organize The Amazing Science Chase, a campus-wide scavenger hunt style event in which participating members of the public are presented with a series of timed science-related challenges within the context of a coherent storyline (*continued below*).

(continued from above) Designed and constructed several challenges for the event using physics and engineering principles. This event was a part of Science Rendezvous, a city-wide science festival in May designed to promote science as being a part of our culture and everyday life.

References

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